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Application of 57Fe Mössbauer spectroscopy as a tool for mining exploration of bornite (Cu5FeS4) copper ore

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Abstract

Nuclear resonance methods, including Mössbauer spectroscopy,are considered as unique techniques suitable for remote on-line mineralogical analysis. The employment of these methods provides potentially significant commercial benefits for mining industry. As applied to copper sulfide ores, Mössbauer spectroscopy method is suitable for the analysis noted. Bornite (formally Cu5FeS4) is a significant part of copper ore and identification of its properties is important for economic exploitation of commercial copper ore deposits. A series of natural bornite samples was studied by 57Fe Mössbauer spectroscopy. Two aspects were considered: reexamination of 57Fe Mössbauer properties of natural bornite samples and their stability irrespective of origin and potential use of miniaturized Mössbauer spectrometers MIMOS II for in-situ bornite identification. The results obtained show a number of potential benefits of introducing the available portative Mössbauer equipment into the mining industry for express mineralogical analysis. In addition, results of some preliminary 63,65Cu nuclear quadrupole resonance (NQR) studies of bornite are reported and their merits with Mössbauer techniques for bornite detection discussed.

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Keywords

Bornite, Mining industry, Mössbauer spectroscopy, NQR